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BY: *Judi E. Morgan*

DATE: April 30, 2002

PATENT

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Patent Application of : Group Art Unit: 1754
Kiyoshi Taguchi *et al.* :
Conf. No.: 8909 :
Appln. No.: 09/549,918 : Examiner: Wayne A. Langel
Filed: April 14, 2000 :
For: Hydrogen Refinement Apparatus : Attorney Docket
: No. 10059-350
: (P22607-01)

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REQUEST FOR RECONSIDERATION

This Request for Reconsideration is being filed in response to the Office Action (Paper No. 7) dated January 31, 2002 in the above-identified patent application.

Claims 1-9 are presently pending in this application.

In the first paragraph on page 2 of the Office Action, the Examiner asserts that the Applicants' traversal of the restriction requirement has been considered but is not persuasive. It is noted that the Applicants did not traverse the restriction requirement in the response that was filed on October 22, 2001. Rather, the Applicants provisionally elected Group I (claims 2-6) for initial examination. The Applicants also requested examination of at least linking claim 1 and elected claims 2-6. Based upon the remarks contained in the present response, it is believed that amended claim 1 is allowable. The restriction requirement should therefore be withdrawn.

In the paragraph near the bottom of page 3 of the Office Action, the Examiner has rejected claims 1-6 under 35 U.S.C. § 112 ("§ 112") as being indefinite. The Examiner contends that the metes and bounds of a "reformed gas feeding part" are indefinite. This rejection is respectfully but strenuously traversed for the reasons set forth in detail below.

The standard used in assessing compliance of a patent claim with the definiteness requirement of § 112 is whether one skilled in the art would understand the bounds of the claim when read in light of the specification. Claim definiteness must be evaluated in terms of the content of the particular specification, teachings of the prior art and the claim interpretation that would be given by one possessing the ordinary level of skill in the art at the time of the invention (M.P.E.P. § 2173.02).

A person skilled in the art would understand the bounds of the reformed gas feeding part of claim 1 from its context and the specification of the present invention. The first clause of claim 1 recites a hydrogen refinement apparatus comprising (a) a reformed gas feeding part for feeding a reformed gas containing at least hydrogen gas and water vapor and (b) a carbon monoxide shifting chamber located downstream from the reformed gas feeding part. It thus is apparent that a reformed gas feeding part is just what it says, namely a constituent component (part) of the claimed hydrogen refinement apparatus which supplies (feeds) reformed gas containing at least hydrogen and water vapor to a carbon monoxide shifting chamber.

The specification discusses one non-limiting embodiment of a reformed gas feeding part, namely a reforming reaction chamber 3 (page 7, line 11 to page 8, line 2; Fig. 1). The reforming reaction chamber 3 contains a heat exchanging fin 2, a reforming catalyst body 3a, a heating burner 4 and an exhaust port 5 (page 7, lines 18-23; Fig. 1). Additional aspects of the operation and products of the reforming reaction chamber 3 are subsequently discussed (page

8, line 19 to page 9, line 16). Thus, the context of claim 1 and the reforming reaction chamber discussed in the specification adequately define the reformed gas feeding part for purposes of § 112.

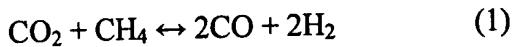
Since improvement of the present invention lies in the carbon monoxide shifting catalyst body, not in the reformed gas feeding part, it is not necessary to provide any details of this part in the claims. It is a part known in the art, namely any source of reformed gas which contains hydrogen gas and water vapor. Since the only formal rejection of claims 2-6 is based upon their dependence from claim 1, these claims also comply with the requirements of § 112. Therefore, reconsideration and withdrawal of the rejection are respectfully requested.

In the paragraph bridging pages 2 and 3 of the Office Action, the Examiner has rejected claims 1-6 under 35 U.S.C. § 103(a) as being unpatentable over UK Patent Application No. GB 2 240 284 A of Basini *et al.* ("British '284"). The Examiner contends that British '284 discloses a catalytic system for the production of synthesis gas by reforming hydrocarbons with carbon dioxide using a catalyst consisting of a platinum group metal on a support comprising aluminum oxide, zirconium oxide and/or cerium oxide. The Examiner asserts that British '284 teaches that the catalyst preferably has a surface area of between $10\text{ m}^2/\text{g}$ and $200\text{ m}^2/\text{g}$. In addition, the Examiner considers the means for feeding carbon dioxide and light hydrocarbons to the reactor of British '284 to constitute the "reformed gas feeding part for feeding a reformed gas containing at least a hydrogen gas and water vapor" as recited in claim 1 of the present invention.

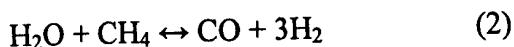
The Examiner argues that the reaction catalyst used in British '284 would inherently be positioned downstream of such means for feeding reactants. Also, the Examiner argues that the difference between the apparatus disclosed in British '284 and the present invention is that British '284 does not specifically teach that the platinum group metal should be

platinum. The Examiner concludes that it would be *prima facie* obvious to use platinum as the disclosed platinum group metal because it is well known that platinum is a platinum group metal and British '284 only teaches that rhodium, ruthenium or iridium are preferred. Furthermore, the Examiner concludes that it is well settled that non-preferred embodiments can serve as the basis of a determination of *prima facie* obviousness. This rejection is respectfully but strenuously traversed for the reasons set forth in detail below.

British '284 discloses a catalytic system for use in a reforming process described in the equilibrium chemical equation (page 1, lines 7-10):



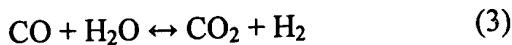
British '284 teaches that processes involving equation (1) have significant advantages over widespread steam reforming processes which are described by the equilibrium chemical equation (page 1, lines 11-14):



From equation (1) it is clear that the means of British '284 for feeding carbon dioxide and light hydrocarbons does not read on applicants' reformed gas feeding part. Thus, neither CO_2 nor CH_4 is a "hydrogen gas" or "water vapor". Whereas British '284 is concerned with producing reformed gas, the present invention is concerned with treating a reformed gas (different from that of British '284).

The reformed gas synthesized in equation (2) contains at least hydrogen, which is the main component, and water vapor. The reformed gas also contains a trace amount of carbon monoxide. However, when the reformed gas is used in a fuel cell, a platinum or similar catalyst is poisoned by the presence of a trace quantity of carbon monoxide. In order to avoid such

contamination, the reformed gas can be treated according to the following equilibrium chemical equation:



Carbon monoxide is removed by shift-reacting with water vapor in the presence of a CO shifting catalyst. The present invention relates to the CO shifting catalyst used in purifying the reformed gas, obtained by steam reformation, according to equation (3). Since the equilibrium shift reaction of equation (3) is exothermic, the temperature of the CO shifting catalyst is preferably as low as, for example, 150 to 450 °C.

Three basic criteria must be satisfied in order to establish a *prima facie* case of obviousness (M.P.E.P. § 706.02(j)). First, there must be some suggestion or motivation, either in the references or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the reference or combination of references must teach or suggest all of the claim limitations.

With regard to the third criterion, British '284 does not teach or suggest all of the elements of the hydrogen refinement apparatus defined in claim 1. As discussed above, British '284 does not render obvious a reformed gas feeding part which feeds a reformed gas containing at least a hydrogen gas and water vapor. British '284 does not disclose any source of a reformed gas of this composition. In addition, British '284 provides no indication of a reaction chamber equipped with a carbon monoxide shifting catalyst body which is positioned downstream from the reformed gas feeding part. Moreover, British '284 does not mention that the recited catalyst body comprises a carrier containing a metal oxide with a BET specific surface area of at least 10 m²/g and platinum supported thereon. The catalyst compositions of British '284 are for use in

the reforming reaction described in equation (1) and not in the carbon monoxide shifting reaction described in equation (3), as in the present invention.

Furthermore, British '284 does not satisfy the first requirement of a showing of *prima facie* obviousness with regard to the present invention. There is no suggestion in British '284 that the device of this patent could be modified in the manner suggested by the Examiner. As discussed above, the catalytic system of British '284 is directed solely to the reforming reaction described in equation (1) and does not relate in any way to the shifting reaction described in equation (3). Therefore, a person of ordinary skill in the art would have had no motivation to realize the hydrogen refinement apparatus of claim 1, the operation of which is based on equations (2) and (3).

In addition, the knowledge generally available to a person of ordinary skill in the art would have been substantially insufficient to enable him or her to conceptualize the present invention. The subject matter of British '284, and the problem that it addresses, are completely different from those of the present invention. British '284 does not provide a person of ordinary skill in the art with any motivation to supply carbon monoxide and water vapor to a reaction chamber equipped with a shifting catalyst body, as is done in the present invention. Also, the teachings of British '284 would not motivate a person of ordinary skill in the art to realize the low temperatures of the present invention. Indeed, the temperature of the catalyst of British '284 is preferably high since the equilibrium reforming reaction of equation (1) is endothermic, unlike the exothermic reaction of equation (3) in the present invention. For instance, Example 1 of British '284 describes the reaction of equimolar quantities of methane and carbon dioxide at a temperature between 300 and 750 °C. Figure 3 of British '284 indicates that the preferable temperature range is from 700 to 800 °C.

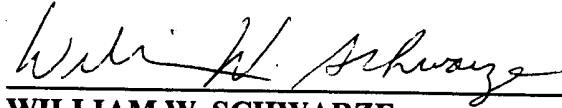
Claims 2-6 depend directly or indirectly from claim 1 and are patentable for the same reasons. Reconsideration and withdrawal of the rejection are respectfully requested.

In view of the foregoing remarks, the Applicants respectfully submit that claims 1-9 fully comply with the requirements of 35 U.S.C. § 112 and are patentably distinguishable over the prior art of record. An early Notice of Allowance is earnestly solicited.

Respectfully submitted,

KIYOSHI TAGUCHI ET AL.

April 30, 2002 By:
(Date)


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